

IN THE CLAIMS

1-20. (*Canceled*).

21. (*Currently Amended*) A process for forming an improved trench MOS-gated device, said process comprising:

- (a) forming a doped upper layer on a semiconductor substrate, said upper layer having an upper surface and an underlying drain region;
- 5 (b) forming a well region having a first polarity in said upper layer, said well region overlying said drain region;
- (c) forming a gate trench mask on said upper surface of said upper layer;
- (d) forming a plurality of gate trenches extending from the upper 10 surface of said upper layer through said well region to said drain region, said gate trenches having sidewalls and floors;
- (e) ~~forming sidewalls and floor in each trench comprising covering said sidewalls and floors with~~ a layer of dielectric material;
- (f) filling each of said gate trenches to a selected level substantially 15 below the upper surface of said upper level with a conductive gate material,
- (g) removing said trench mask from the upper surface of said upper layer without removing the layer of dielectric material covering said sidewalls of said trenches;

(h) forming an isolation layer of dielectric material on the upper surface
20 of said upper layer and over said dielectric material covering said sidewalls
within said gate trench, said isolation layer overlying said gate material and
substantially filling said trench;

(i) removing said dielectric layer isolation layer from the upper
surface of said upper layer, ~~said dielectric layer a portion of said isolation~~
25 layer remaining within and substantially filling said trench, and having an upper
surface that is substantially coplanar with the upper surface of said upper layer,

(j) forming a plurality of heavily doped source regions having a second
polarity in said well region, said source regions extending to a selected depth
from the upper surface of said upper layer where said selected depth is
30 substantially coplanar with the level of the conductive gate material in the trench,
said step of forming a plurality of heavily doped source regions comprising
implanting the entire upper surface of said substrate with [[a]] ions of said
second polarity, then forming a body mask on the upper surface of said
substrate, ~~said mask comprising openings transverse to said trenches~~;

35 (k) forming a plurality of heavily doped body regions having a first
polarity at the upper surface of said upper layer, said body regions overlying the
drain region in said upper layer, said step of forming a plurality of heavily
doped body regions comprising doping the upper surface of said substrate with
a dopant of said first polarity, then removing said body mask; and

40 (I) forming a metal contact to said body and source regions over the
upper surface of said upper layer.

22. (*Original*) The process of claim 21 wherein said substrate comprises
monocrystalline silicon.

23. (*Original*) The process of claim 21 wherein said upper layer
comprises an epitaxial layer.

24. (*Canceled*).

25. (*Previously Presented*) The process of claim 21 wherein one of said
source regions surround said body regions and the source regions are separated
from each other by trenches.

26-33. (*Canceled*).

34. (*Currently Amended*) The process of claim 21 wherein said dielectric
material **forming** **covering** said sidewalls[[,]] **and** said floor, and **forming** said
isolation layer in said gate trench comprises silicon dioxide.

35. (*Original*) The process of claim 21 wherein said conductive gate material within said gate trench is selected from the group consisting of a metal, a silicide, and doped polysilicon.

36. (*Original*) The process of claim 21 wherein the selected level of gate material in the trench is substantially coplanar with the selected depth of the source regions in the upper layer.

37. (*Previously Presented*) The process of claim 21 wherein said first polarization polarity is P and said second polarity is N.

38. (*Previously Presented*) The process of claim 21 wherein said first polarity is N and said second polarity is P.

39. (*Original*) The process of claim 21 wherein said device is selected from the group consisting of a power MOSFET, an insulated gate bipolar transistor, an MOS-controlled thyristor, and an accumulation FET.

40. (*Presently Amended*) A process for forming an improved trench MOS-gated device, said process comprising:

- (a) forming a doped upper layer on a semiconductor substrate, said upper layer having an upper surface and an underlying drain region;
- 5 (b) forming a well region having a first polarity in said upper layer, said well region overlying said drain region;
- (c) forming a gate trench mask on said upper surface of said upper layer;
- (d) forming a plurality of gate trenches extending from the upper surface of said upper layer through said well region to said drain region, said gate trenches having sidewalls and floors;
- 10 (e) ~~forming sidewalls and floor in each trench comprising covering said sidewalls and floors with~~ a layer of dielectric material;
- (f) filling each of said gate trenches to a selected level substantially below the upper surface of said upper level with a conductive gate material,
- 15 (g) removing said trench mask from the upper surface of said upper layer;
- (h) forming an isolation layer of dielectric material on the upper surface of said upper layer and over said dielectric material covering said sidewalls within said gate trench, said isolation layer overlying said gate material and substantially filling said trench;
- 20 (i) removing said ~~dielectric layer isolation layer~~ from the upper surface of said upper layer, said dielectric layer a portion of said isolation

layer remaining within and substantially filling said trench, and having an upper
25 surface that is substantially coplanar with the upper surface of said upper layer,

(j) implanting and diffusing into the surface of the substrate source
dopants having a second polarity to form a plurality of heavily doped source
regions that extend into the substrate along the sides of the trenches;

(k) implanting and diffusing into the surface a plurality of heavily doped
30 body regions having a first polarity, said body regions overlying the drain region
in said upper layer; and

(l) forming a metal contact to said body and source regions over the
upper surface of said upper layer.

41. (*Original*) The process of claim 40 wherein the depth of the level of
the diffused implants for the source regions is substantially coplanar with the
level of the conductive gate material in the trenches.